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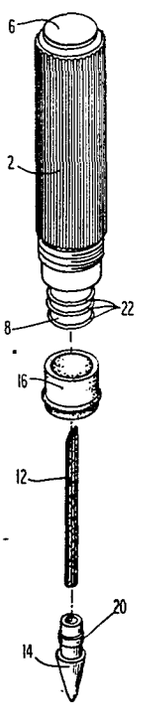
(54) Improved instrument marker pen.

(57) A recorder instrument marker pen of the type adapted for high speed printing, provided with a self-damping resilient shock absorbing member (16) for holding the writing tip. The shock absorbing member (16), typically elastomeric, is positioned adjacent the writing tip portion (14) of the marker to provide for a substantially constant pressure on the writing tip, to reduce pen skipping, increase writing tip life, and provide for a consistent mark upon the desired substrate. The shock absorbing member (16) is substantially self-damping in that vibration or the like associated with high speed writing, is quickly dissipated without undue oscillatory motion. The self-damping, resilient, shock absorbing member (16) is preferably utilised in conjunction with ballpoint or extruded plastics nib type writing elements.



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Specification

Improved Instrument Marker Pen

The present invention relates to a marker or pen of the type adapted for use in recorder instruments and, in particular, to a marker or pen adapted to make a line trace of consistent density and width, even at high trace speeds and on writing surfaces with minor surface irregularities. The terms "marker", "pen", "marker pen", and possibly other terms of similar import are all used interchangeably herein, unless otherwise indicated in the context of a specific usage.

Writing devices with resiliently mounted writing tips are known. U.S. Patents 1,043,518 (Gerspacher), 2,231,410 (Kern et al), and Reissue 23,256 (Engel, Jr.) disclose devices wherein the writing tip portions of pencils are supported by yieldable members. In U.S.

Patent 2,231,410 (Kern et al), a resilient sleeve is provided about a graphite rod stylus securely within the pencil supporting structure. The Engel device, which uses a coil spring, is said to be useful also in a fountain pen.

U.S. Patent 225,914 (Baur) discloses a stylographic fountain pen wherein a spring member is provided to support a stylus in a frame structure.

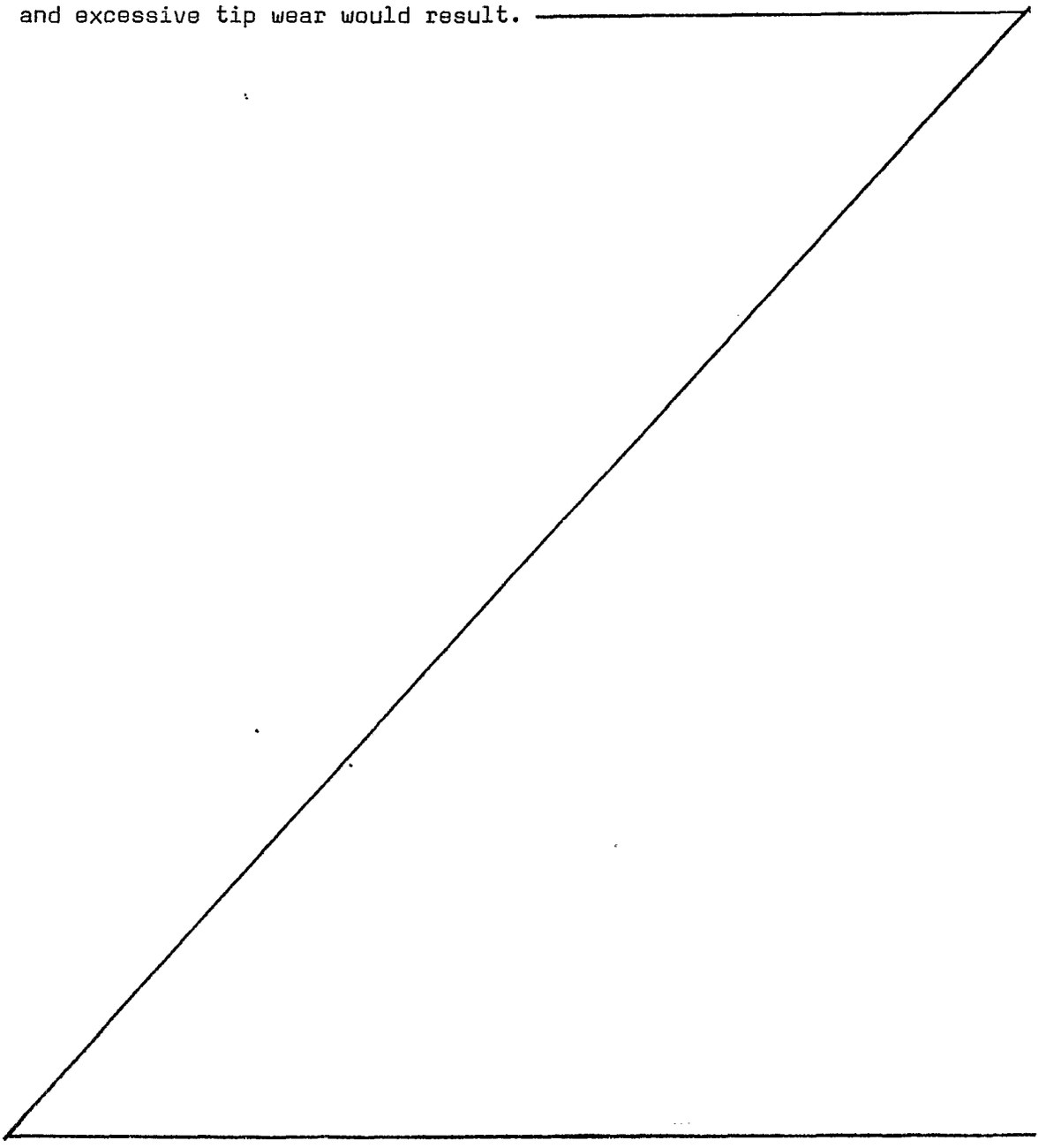
Constant writing pressure can also be effected in a coil spring biased writing element, as shown in U.S. Patent 2,641,226 (Patterson).

In U.S. Patents 2,097,266 (Vosbikian et al) and 3,337,124 (Matsumoto), coil springs or the like are provided to bear against the writing tip portion of the pen or pencil. In these devices, the spring is utilised to actuate a valve to open or block ink communication between the ink reservoir and writing element. A similar spring loaded valve in another type of liquid dispenser is disclosed in U.S. Patent 2,613,382 (Patterson).

U.S. Patents 2,996,750 (Cholet) and 3,153,804 (Silver) disclose utilisation of other types of resilient members in proximity to the writing tips of markers in order to actuate valve openings to supply ink to the writing tips thereof.

The foregoing teachings of the prior art are not considered suitable or readily adaptable for use in conjunction with high speed

recorder instruments, wherein the marker must absorb shock (such as may be caused by surface irregularities) or vibration imparted by marker traverse along the desired writing substrate, while following the contour of the substrate surface and applying a relatively constant writing pressure. Rather the yieldable mountings in these teachings would be expected generally to be excessively yieldable and oscillatory. Thus, in a high speed instrument marker, uneven writing and excessive tip wear would result.



Particularly in those prior art devices characterized by utilization of a coil spring or the like to bear upon the writing element, the coil spring would typically be expected to oscillate after being subjected to shock or vibration and this would not be expected to provide a consistent mark upon the substrate due to the oscillation phenomena.

Accordingly, it is an object of the present invention to provide a marker of the type adapted for utilization in high speed recorder instrument devices which marker minimizes the effect on the writing tip of shock or vibration caused by the writing surface or impact of the marker tip when engaging the writing surface.

A more particular object of this invention is to provide a marker, through which steady writing pressure is applied and which tends to follow writing surface contours with quick and non-oscillatory recovery from surface irregularities, even at high writing or trace speeds.

Briefly, the shock absorbing marker of this invention includes a shock absorbing elastomeric member interposed between the writing tip and a holder therefor, typically an ink reservoir holder, such that writing pressure is applied through the shock absorbing member. Preferably this member comprises a resilient disk generally parallel to the plane of the writing surface and secured at its perimeter to the holder and at its center to the writing tip and/or tip holder. At its perimeter, the disk may include a dependent sleeve or skirt mounted on the end of the holder coaxially with respect to an ink transporting wick, which wick is adapted to conduct ink from the ink reservoir of the pen to the writing tip.

The elastomeric material provides a substantially "self-damping" shock absorbing system, similar to the provision of automobile shock absorbers which constantly maintain contact between the tires and road surfaces despite bumps and surface irregularities over which the car travels.

This shock absorbing characteristic is most significant in pens or markers intended for high speed writing or tracing. Such pens or markers normally

require a low surface tension ink, which is readily releasable from the pen nib, so as to deposit a uniform impression notwithstanding the high trace speed. However, this ink property tends to accentuate non-uniformities, which would otherwise be produced by surface bumps and irregularities in the writing surface. The shock absorbing characteristic of the markers or pens of the present invention tends to counteract this problem.

The markers or pens of the present invention are also adapted, in the preferred form of the present invention, to utilize such low surface tension inks with a minimum of other related problems, particularly including bleeding and leaking of the low surface tension ink from marker or pen components. Specifically, in the preferred form of the present invention, the shock absorbing marker includes a nib holder, which moves with the resiliently mounted nib and which occupies otherwise void space within the marker around the nib to prevent any large accumulation of liquid ink within the marker. During shipment and use, ink pooled in this manner will leak from the marker through vents or other openings. The greater the accumulation, the greater is this problem, so reducing the possible accumulation is found to reduce the tendency of the marker to leak.

Similarly, the preferred embodiment of the present invention includes an outer cap with a slight vent hole. This prevents forming a negative pressure, which would tend to draw ink from the marker, as the cap is removed.

For a better understanding of the marker pen of the present invention, reference may be made to the drawings accompanying and forming a part of this specification, wherein reference numerals designate the same or similar parts. In these drawings,

Figure 1 is an exploded view of a ballpoint recorder instrument marker pen embodiment in accordance with the invention;

Figure 2 is a cross-sectional view of the marker pen shown in Figure 1, with a cap member affixed thereto and shown in dot-dash lines;

Figure 3 is an exploded view of another embodiment of the present invention wherein the marker pen is provided with an extruded plastic nib;

Figure 4 is a cross-sectional view of the instrument marker pen shown in Figure 3;

Figure 5 is an exploded view of another marker pen with extruded plastic nib; and

Figure 6 is an assembly view, partially in cross section, of the instrument marker pen shown in Figure 5, also including cap members affixed thereon.

Referring specifically to Figures 1 and 2, there is shown a ballpoint instrument pen adapted to produce a high speed uniform trace. More specifically, this pen comprises a body member 2 housing a fibrous reservoir 4 with a rear closure 6 and a front neck portion 8 having a reduced diameter throat 10 through which projects an ink feeding wick 12, one end of which projects into fibrous reservoir 4 and the other end of which fits into a ball writing tip assembly 14.

Ball writing tip assembly 14 is resiliently mounted on front neck portion 8 through a mating elastomeric nib holder 16 having a front disk 18, secured at its periphery to the front of neck portion 8 by a dependent skirt fit over the outer circumference of body

portion 8. Ball writing tip assembly 14 is held in engagement, in a central opening of disk 18, by a short plastic sleeve member 20 fit over the outer perimeter of the shaft of ball writing tip assembly 14 just aft of front disk 18 of elastomeric nib holder 16, with clearance around the outer diameter thereof, however, to permit relatively free axial movement of ball writing tip assembly 14, upon deflection of front disk 18, within front neck portion 8 of body member 2.

In this embodiment of the present invention, ink feeding wick 12 is securely retained in ball writing tip assembly 14 by means of a stake or inward dimple, such as may be produced by thermal hot tip or ultrasonic deformation on the shaft portion of ball writing tip assembly 14. A vent means, shown as a hole 33 through front disk 18, is also provided to permit entry of air into the reservoir-containing body member 2. Ridges 22 are provided on the outer perimeter of front neck portion 8 to better retain elastomeric nib holder 16 and a protective cover 24 is secured over the writing tip of the assembly and mates in fluid tight sealing enagement with seal ring 34 on elastomer nib holder 16.

In Figures 3 and 4, an extruded nib version of the resiliently mounted instrument marker pen of the present invention is shown. More specifically, the

extruded nib version also includes body member 2 with front neck portion 8 and elastomeric nib holder 16. The writing element in this form of the invention comprises an extruded plastic material nib 26, projecting from fibrous reservoir 4 to the writing tip end thereof. Nib element 26 projects through reduced diameter throat 10 of front portion 8 of body 2 and is retained in a central opening of front disk portion 18 of elastomeric nib holder 16 by a nib adaptor member 28. Nib adaptor member 28 includes, in this embodiment of the invention, a polygonal central hole 30 for venting of the interior of case 2 around the periphery of nib 26. Nib adaptor member 28 also includes an indentation 32 with opposed facing surfaces on either side thereof, within which is fit the peripheral edge of the central opening of the front disk portion 18.

In Figures 5 and 6 there is shown the preferred form of the present invention, which is a marker similar to that shown in Figures 3 and 4, differing however in several significant respects. In particular, the marker of Figures 5 and 6 is better adapted for use with low surface tension inks of the type normally required in high speed tracing instruments. Referring only to those features of the Figure 5-6 embodiment which differ from the design shown in Figures 3 and 4, it will be noted

that fibrous reservoir 44 projects lower within the marker body 48 so as to leave less void space between reservoir 44 and nib adaptor member 40. Nib adaptor member 40 also includes a rear cylindrical segment 42 dimensioned to permit free vertical travel within the forward projection 46 of marker body 48. The upper end of rear segment 42 is also configured to occupy most of the void space within the forward projection 46 of marker body 48 so as to avoid unnecessary void space therein. A slight remaining void 43 is permitted, however, between the rear end 42 and the front end of fibrous reservoir 44 so as to prevent physical contact thereof. As shown, in this embodiment of the invention, nib 50, an extruded nib commercially available from Uchida Yoko of Tokyo, Japan is cut to a rear taper in which the central capillary portion of the extruded nib is exposed along a short length thereof and the entire rear end of the nib rides relatively freely within a cylindrical recess 45 at the front end of fibrous reservoir 44.

The rear cylindrical portion 42 of nib adaptor member 40, by occupying most of the void space within the forward projection 46 of marker body holder 48, prevents any large accumulation of liquid ink bled from fibrous reservoir 44. In addition, it serves as a stand pipe to prevent any significant amount of liquid ink

lying adjacent a vertical length of nib 50, thereby limiting the tendency of any ink to bleed down through the vent spaces along the length of nib 50.

Nib adaptor member 40 also includes a polygonal nib receiving hole 52 to provide vent spaces around nib 50 and along the length thereof. In some applications, however, nib receiving hole 52 may be polygonal only through part of the length of nib adaptor member 40. In particular, the nib-receiving hole 52, is annular, in at least one form of the present invention, from recess 32 of nib adaptor member 40, forward, so as to prevent any tendency of the nib 50 to cause deformation of the forward portion 54 of nib adaptor member 40. Such deformation may result in undesirable loss of clearance of the marker with the instrument in which it is mounted, in some applications.

It will also be noted that in the marker of Figures 5 and 6, vent hole 33 (seen in the marker of Figures 3 and 4) is eliminated in view of the provision of vent holes along the length of nib 50 by the polygonal nib-receiving hole 52.

To prevent ink bleeding and leaking during shipment, the marker of Figures 5 and 6 also includes a

tightly fitting inner nib cap 56 and a threadedly received outer nib cap 58. However, nib cap 58 includes a forward vent hole 60 to preclude any tendency to develop a negative pressure within nib cap 58, as it is removed. Such a negative pressure tends to draw liquid ink, within the marker, out through the vent spaces of the marker.

With regard to the essential element of a resilient mounting means for the writing tip or nib in an improved instrument marker pen of the present invention, the resilient mounting means may take any of various shapes or forms, so long as the shape and material selection is made in a manner adapted to permit the writing element to produce a relatively constant and uniform width writing trace at relatively high speed and at relatively low writing pressure, notwithstanding irregularities in the writing surface. According to the present invention, it is preferred, though not necessarily critical, that the resilient mounting means comprise a cylindrical or sleeve-like member fitting over and mating with the forward projecting portion of the pen body, with a forward disk which deflects inwardly. Obviously a variety of other designs may also be devised to accomplish a similar result. With regard to material selection, it is absolutely critical that

the material, together with the geometric design of the mounting means, comprise a yielding or resilient material which however tends to return from a deformed state without oscillation. In this respect not all elastic or spring members are suitable. Elastomeric materials are generally suitable and in the preferred forms of the present invention, the resilient nib holder is composed of EPDM rubber. Other rubbery or elastomeric materials may also be used however, such as natural rubber, and synthetic rubber, including SBR rubber, butyl rubber, polybutadiene, ethylene propylene rubber, neoprene, NBR rubber, polysulfide rubber, polyurethane, silicone rubber, hypalon, and acrylics and fluoroelastomers in general. Elastomeric sponge materials may also be used.

Preferably, the writing tip or nib is retained, generally through a nib adaptor member, in a central opening of a resilient disk member, secured at its periphery to the marker body. Bending deflection of the disk member, over a free moving disk radius (to its secured peripheral edge) on the order of $\pm$1 millimeter, with nib vertical movement limited to about $\pm$1 millimeter, is sufficient with a disk member durometer value on the order of 50 shore A (i.e., durometer measured on Shore gauge, scale A), to produce the highly desirable shock absorbing characteristic described herein.

Examples

The significant improvement in marker pens for high speed uniform tracing produced by the present invention was demonstrated in a series of instrument marker pens in which marker pens with elastomeric nib holders to provide a resiliently mounted tip, as described above, were compared to comparable pens with identical elements but in which the tip was otherwise non-yieldingly mounted within the marker case. Four plots, on sheets labeled A through H, were made with each of eight pen combinations as indicated in the Table which follows (the designation "ips" referring to trace speed in inches per second):

TABLE

Sheet	Marker Tip	Elastomeric Holder	Plot #1		Elastomeric Holder	Plot #2	
			Speed (ips)	Pen Pressure (gms)		Speed (ips)	Pen Pressure (gms)
A	Ball Tip	Yes	22	40	Yes	22	40
B	Ball Tip	No	22	40	No	22	40
C	Ball Tip	No	8	40	No	10	40
D	Extruded Nib	Yes	22	40	Yes	22	40
E	Extruded Nib	No	22	40	No	22	40
F	Extruded Nib	No	8	40	No	12	40
G	Extruded Nib	No	22	40	No	22	40
H	Extruded Nib	No	22	20	No	22	10

TABLE (Continued)

Sheet	Marker Tip	Elastomeric Holder	Plot #3		Elastomeric Holder	Plot #4	
			Speed (ips)	Pen Pressure (gms)		Speed (ips)	Pen Pressure (gms)
A	Ball Tip	Yes	22	40	Yes	22	40
B	Ball Tip	No	22	40	No	22	40
C	Ball Tip	No	12	40	No	14	40
D	Extruded Nib	Yes	22	40	Yes	22	40
E	Extruded Nib	No	22	40	No	22	40
F	Extruded Nib	No	14	40	No	16	40
G	Extruded Nib	No	22	40	No	22	40
H	Extruded Nib	Yes	22	20	Yes	22	10

The sheets and plots thus produced were visually compared for skipping tendency and line consistency or uniformity. Pens utilizing the elastomeric holder mounting means were found consistently to produce plots which were generally more uniform and continuous than those produced by pens not having the elastomeric nib holders. This significant difference was even more noticeable on the high writing speed plots, namely the twenty-two inch per second plots and a more significant improvement was noted for the ballpoint pen markers versus the non-resiliently mounted ballpoint pen markers, than in the extruded nib markers.

Indeed, in plot 1, the ball tip marker with non-resilient tip mounting produced a plot at eight inches per second (Sheet C) not significantly different than the ball tip marker with resilient nib holder writing at twenty-two inches per second (Sheet A). This may be interpreted as a three fold increase in writing speed in the ball tip marker.

Similarly, the extruded nib marker with resilient nib holder at twenty-two inches per second (Sheet G) produced a marker with uniformity and consistency similar to that of the extruded nib marker with non-resilient nib mounting at sixteen inches per second (Sheet F).

Still further, Sheet H, plot 1 demonstrates that an extruded nib marker with non-resilient nib mounting at a pressure of 20 gms. produced a trace of uniformity and consistency not significantly different than the extruded marker with the resilient nib holder at a pressure of 10 gms. (Sheet G, plot 4). Thus in the extruded nib marker version with resilient nib holder, comparable trace quality is produced with effectively half the writing pressure (significantly improving expected nib life) as compared to the non-resilient mounted extruded nib marker.

Accordingly, it is apparent that the present invention provides a significant improvement in high speed writing instrument marker pens. This is done by the provision of a self-damping shock absorbing structure for utilization in a recorder instrument writing element of the type adapted for high speed printing applications.

It will be apparent to those skilled in the art that the present invention is not limited to the particular construction and arrangements shown and described, and that changes and modifications may be made without departing from the spirit and scope of the

invention. One such modification is the possible substitution of a relatively hard fibrous nib element for the extruded plastic nib element shown and described above. The appended claims should be construed so as to cover all such changes and modifications.

Claims

1. A recorder instrument marker pen comprising a body, an ink reservoir, a writing tip and an ink transport means for conducting ink from said ink reservoir to said writing tip, characterised by the position of self-damping, shock absorbing resilient holding means in which said tip is secured and which is in turn secured to said body, said means being adapted to permit said writing element to produce a relatively constant and uniform writing trace at relatively high speed at relatively low writing pressure and notwithstanding irregularities in the writing surface.

2. Recorder instrument marker pen as claimed in claim 1, wherein said self-damping shock absorbing means comprises an elastomeric member.

3. Recorder instrument marker pen as claimed in claim 2, wherein said elastomeric tip holder member comprises a disk portion and means for securing said disk portion firstly at the periphery thereof to said body and secondly at the center thereof to said tip.

4. Recorder instrument marker pen as claimed in claim 3, wherein said shock absorbing means includes a dependent circumferential skirt adapted to fit over a mating portion of said marker body.

5. Recorder instrument marker pen as claimed in claim 3 or claim 4, wherein said writing tip is retained in a tip adaptor, said tip adaptor being secured to said disk portion of said shock absorbing member, said tip adaptor having an inner segment configured to conform to the interior

of said body in the segment thereof between said reservoir and the end thereof at which said shock absorbing means is mounted and to oscillate freely therewith, in response to bending deflection of said disk portion.

6. Recorder instrument marker pen, as recited in claim 5, wherein the space within said marker body between said disk portion and said reservoir is substantially occupied by said inner segment.

7. Recorder instrument marker pen as claimed in any of claims 1 to 6, wherein said writing tip comprises a ball and wherein said ink transporting means comprises a fibrous wick.

8. Recorder instrument marker pen as claimed in claim 7, further comprising a ball support member having a generally conically shaped end portion with an aperture therein for reception of said ball, said ball support member further having an annular ridge provided therein, against which said front disk portion is retained by a resilient sleeve fitting over a rearward shaft portion of said ball support member, with clearance between said resilient sleeve and said body to permit relative axial deflection therebetween.

9. Recorder instrument marker pen as claimed in any of claims 1 to 6, wherein said writing tip and said ink transporting means comprise an extruded plastics nib.

10. Recorder instrument marker pen as claimed in claim 9, further comprising a nib adaptor surrounding said plastics nib, said nib adaptor being provided with an annular recess therein in which is received said disk portion of said elastomeric shock absorbing means.

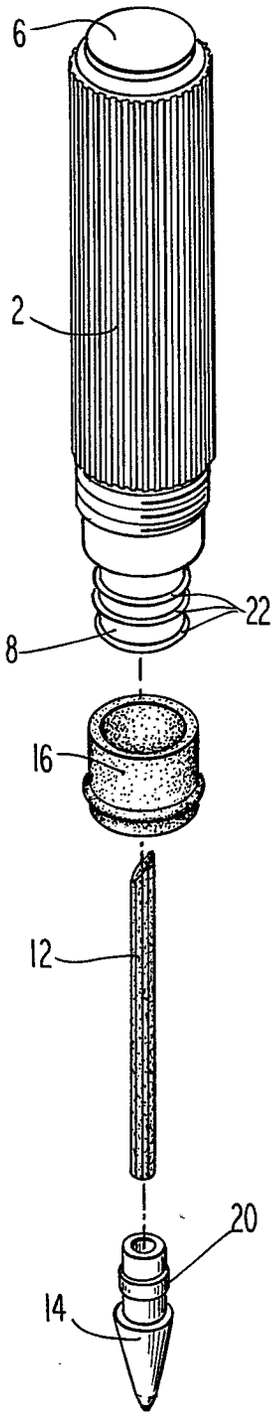


Fig. 1

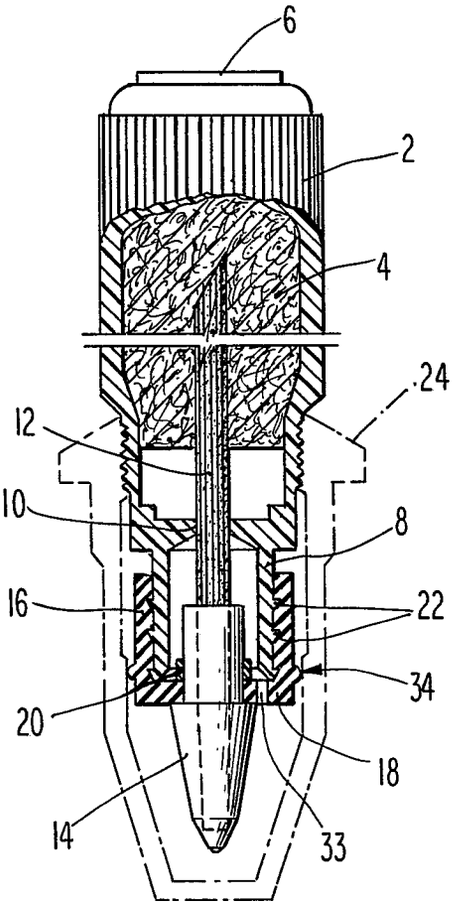


Fig. 2

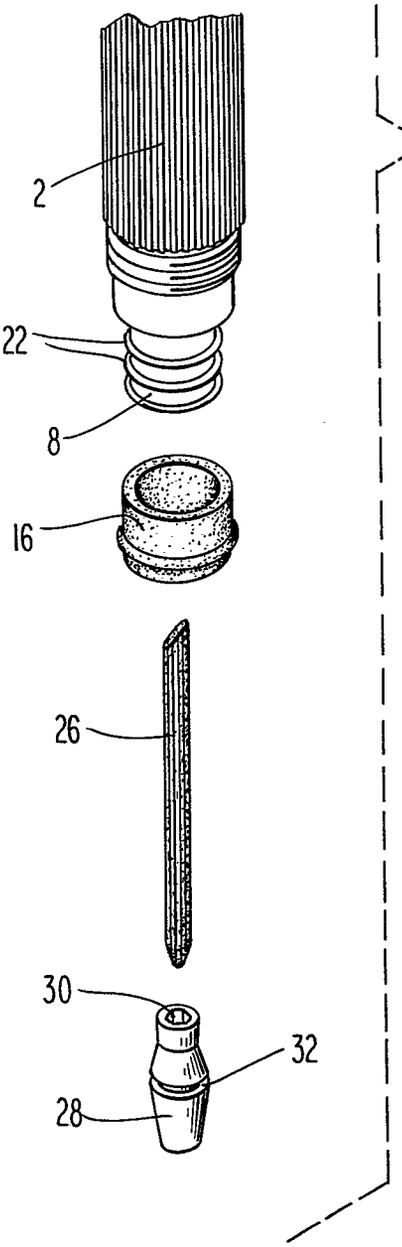


Fig. 3

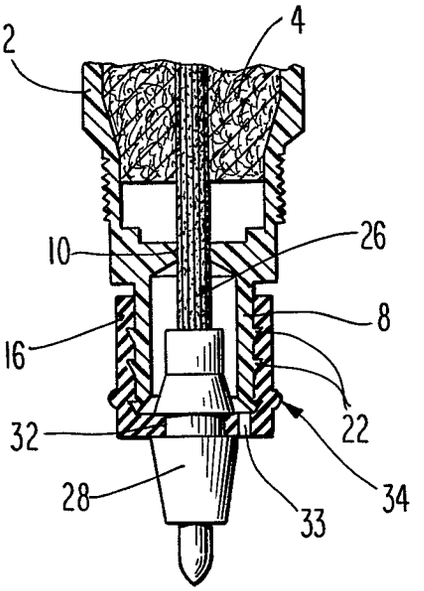


Fig. 4

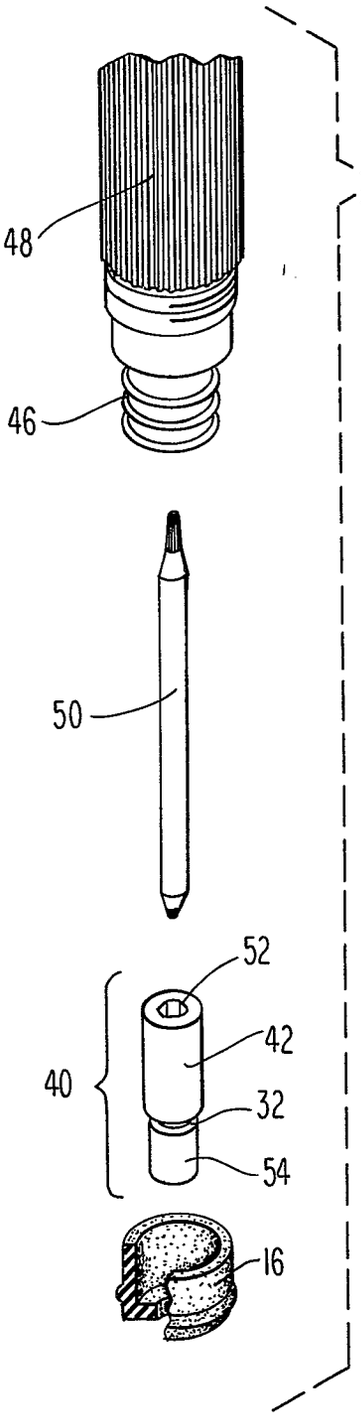


Fig. 5

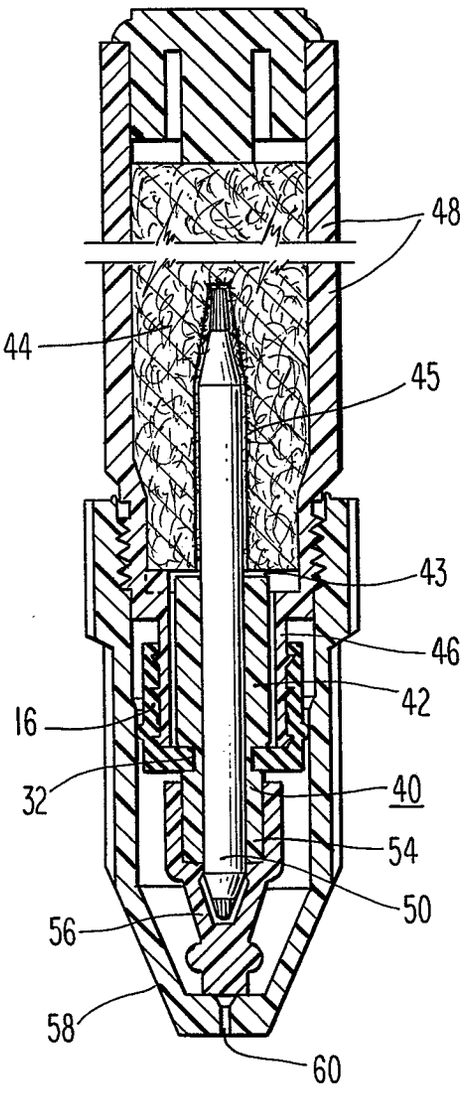


Fig. 6

European Patent Office

EUROPEAN SEARCH REPORT

0042289
Application number
EP 81 30 2683

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
X	FR - A - 1 118 536 (BACOU) * Page 1, column 2, lines 33-41 *	1,2,4
X	FR - A - 1 137 937 (BACOU) * Page 1, column 2, line 32 to page 2, column 1, line 7 *	1,2,8
X	FR - A - 1 151 093 (MARION) * Page 1, column 2, lines 13-41; page 2, column 1, line 12 to column 2, line 11 **	1-3
X	GB - A - 669 464 (COMPANIA-URUGUAYA DE FOMENTO INDUSTRIAL) * Page 3, lines 26-35 *	1,2
X	DE - C - 885 070 (ORZELLET) * Page 2, lines 62-115 *	1-3
A	FR - A - 1 252 736 (BACOU) * Figures 3,4 *	4
A	US - A - 3 972 629 (WHALEN) * Column 5, lines 5-17 *	7
A	US - A - 3 338 216 (ROLLER) * Column 2, lines 71-72 *	9

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CLASSIFICATION OF THE APPLICATION (Int. Cl.³)

B 43 K 7/00
8/02

TECHNICAL FIELDS SEARCHED (Int. Cl.³)

B 43 K

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	18-09-1981	LAMMINEUR

EPO Form 1503.1 06.78

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.³)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	US - A - 3 003 181 (ROSENTHAL) * Figure 2 * --	5,10	
A	US - A - 3 397 938 (JUELSS) * Figures 1,2 * --	5,10	
A	US - A - 3 614 246 (LOTFALLAH) * Column 3, lines 6-18 * ----	3	TECHNICAL FIELDS SEARCHED (Int. Cl.³)